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The potential contribution of Bilby (*Macrotis lagotis*) digging to rangeland restoration at Lorna Glen

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Background

Lorna Glen pastoral station was purchased by the Western Australian Government in 2000 and it is now co-managed, with the Martu Aboriginal people, for the purposes of conservation.

Other studies conducted in rangelands have shown that restoration may not be achieved by stock removal alone, but additional interventions may be needed to de-compact the soil, capture resources and improve microclimate conditions. This can be achieved via mechanical means, such as pitting and furrowing, or by re-instating the digging fauna that once fulfilled this role.

This study quantified the extent of soil modification by re-introduced bilbies and sought to determine if bilby digging activity was likely to contribute to ecosystem restoration at Lorna Glen.

Findings

A survey found that the density of bilby diggings was six times that of goannas (*Varanus panoptes* or *V. gouldii*) and 20 times that of European rabbits (*Oryctolagus cuniculus*). This shows that the influence of bilbies on soil modification was more important than that of any other vertebrate species present in the same habitat.

Photo: Bert and Babs Wells / DEC

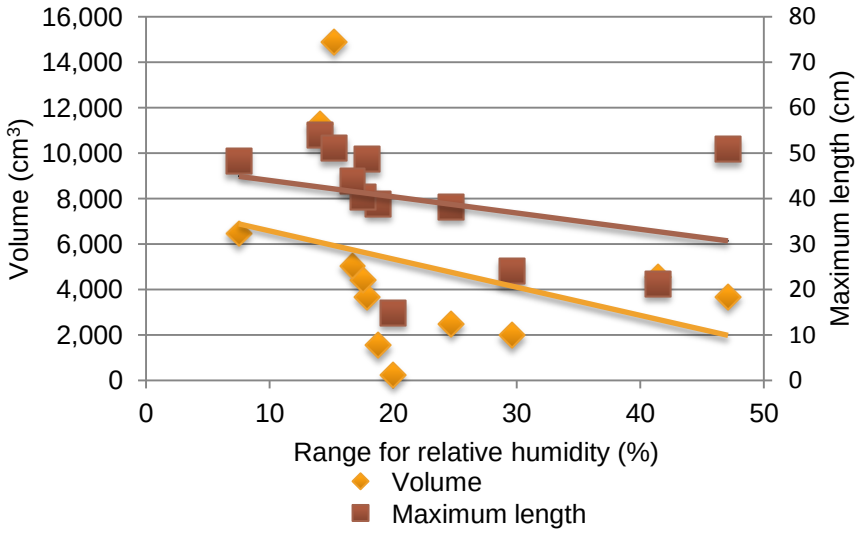
Soils from bilby diggings had significantly higher pH, probably because the bilbies had removed the acid sands from the topsoil and exposed more alkaline sub-soil. Soil acidity regulates the activity of soil fungi and microbes and the availability of soil plants.

Soil pH ($CaCl_2$) was positively correlated with exchangeable magnesium and potassium and negatively correlated with bio-available aluminium. Therefore, bilby digging activity may have (indirectly) increased the availability of beneficial nutrients and reduced the availability of potentially toxic aluminium (see table below).

Comparison of soil chemical properties for diggings and undisturbed soil using discriminant analysis (n = 12). Significant probability values are shown in bold, s.e. = standard error.

Soil constituent	Spoil mound		Undisturbed soil		Results	
	Mean	s.e.	Mean	s.e.	F	P
Ammonium + nitrate (mg/kg)	8.7	1.8	2.8	0.3	10.4	**0.0038**
pH ($CaCl_2$)	4.7	0.1	4.5	0.04	5.7	**0.0254**
Exchangeable Calcium (meq/100g)	0.4	0.04	0.3	0.1	1.2	0.2807
Exchangeable Magnesium (meq/100g)	0.2	0.01	0.1	0.01	32.3	**<0.0001**
Exchangeable Potassium (meq/100g)	0.3	0.03	0.2	0.02	7.5	**0.0118**
Aluminium ($CaCl_2$, mg/Kg)	2.5	0.5	5.8	1.0	9.1	**0.0063**
Cation exchange capacity (meq/100g)	0.9	0.1	0.6	0.1	7.7	**0.0110**

During the daytime, diggings had significantly higher mean relative humidity and significantly lower wind speed than undisturbed soil. At night, mean temperature was significantly higher and mean relative humidity was significantly lower for diggings than undisturbed soil. Diggings also had significantly lower range for temperature and relative humidity than undisturbed soil at night. Digging volume and maximum digging length range were negatively correlated with range for relative humidity at night (see graph below). The milder and more stable microclimate conditions in the diggings are likely to favour the nitrogen mineralising activity of soil fungi, fauna and bacteria and this may account for the elevated ammonium and nitrate recorded in the diggings.



Relationship between range for relative humidity, digging volume and maximum digging length for nocturnal microclimate observations. Lines show linear relationships.

The soils that were ejected from the diggings by the bilbies formed spoil mounds that were significantly less compact than the adjacent undisturbed soil. Soil de-compaction would be an especially important ecosystem function performed by bilbies at Lorna Glen, because high soil strength inhibits plant productivity.

Management Implications

Restoration of former rangelands can be particularly challenging due to the impact of grazing on soils and the severely resource limited environment. The re-introduction of digging fauna, like bilbies, helps reverse some of the more limiting habitat conditions, such as soil compaction, lack of nutrients and harsh microclimate. This has a number of benefits for habitat regeneration because it can increase the abundance and diversity of plants that subsequently grow in bilby diggings. Re-introduction of bilbies, therefore, offers a self-sustaining means of restoring soil health and plant productivity in rangeland ecosystems.

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